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"The most valuable gift which the Hand of Science has ever yet offered to the Artisan." *Dr. Birkbeck.*

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Plan of a TOW-BOAT *for navigating Rapids in Rivers.*—BY E. CLARK.

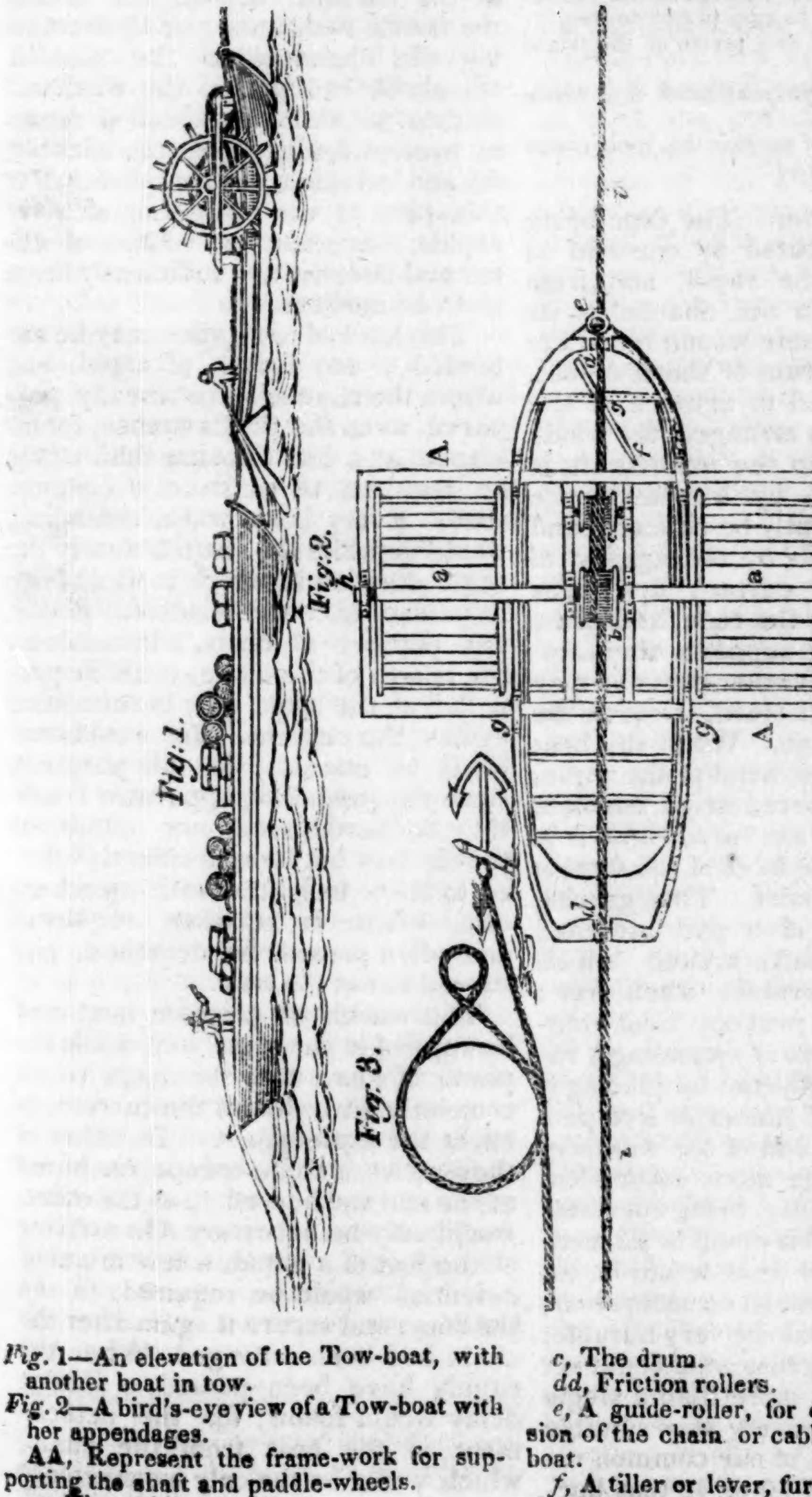


Fig. 1—An elevation of the Tow-boat, with another boat in tow.

Fig. 2—A bird's-eye view of a Tow-boat with her appendages.

AA, Represent the frame-work for supporting the shaft and paddle-wheels.

aa, The paddle-wheels.

b, The windlass.

c, The drum.

dd, Friction rollers.

e, A guide-roller, for directing the accession of the chain or cable at the bow of the boat.

f, A tiller or lever, furnished with a swivel roller at *g* for the rope to pass over, secured by a bolt at the bow of the boat, and

sliding on the bar *g*: it is designed to assist in steering the boat.

g, A cross-bar, perforated in several places, for the reception of pins to secure the tiller at different angles from the direction of the boat.

NOTE.—It should be remarked, that, when this lever is made to vary from the parallel direction of the boat, the rope is thrown from the friction roller, *(d)* in the bow, and is received over the bow gunwale, which occasions the boat to vary in her course.

hh, Pivot-boxes and pivots of the wheel shaft.

ii, Chain or rope, extended the whole length of the rapid.

Fig 3 Manner of passing the rope round the windlass and drum.

Modus operandi. The rope being permanently secured by one end at the head of the rapid, and from thence passed in the channel to its termination, is there wound round the windlass and drum of the tow-boat, as is represented in figure 3 of the engraving. Thus arranged, the windlass, in respect to the main shaft, is placed in *gear*, by a contrivance which will presently be noticed; and the water-wheels by the agency of the descending current are thus made to wind up the rope, and draw the boat, which supports them, together with such other boats as may be fastened to its stern, towards the place of anchorage. When the boat has arrived at the head of the rapid, and is disencumbered of its burthen, the windlass is *ungeared*, and it is borne back by the force of the stream to the starting point. This gearing consists simply of a pall attached to the main shaft, around which the windlass revolves when free; its office is to prevent this rotation, while the boat is ascending a rapid, and this is effected by placing it against a piece of timber or iron projecting from the end of the windlass. A chain would be more economical than a rope, because, being constantly wet, its oxidation would be exceedingly slow, and its wear would be too inconsiderable to merit consideration; consequently it would be very durable; while a hemp or grass rope could not be relied on for more than a single season. A chain every way suitable for the navigation of our common rapids, with boats of 30 or 40 tons burthen, would not cost over 30cts. per foot; and one sufficiently strong for the passage of still larger boats over the most rapid navigable falls which any of our rivers present, it is believed would not cost over fifty cents for the same length.

It will readily be perceived, that the power may be augmented almost at pleasure, by increasing the surface of the paddles, exposed to the action of the current, beyond the area of the boat's resistance; or by increasing the diameter of the paddle-wheels beyond that of the windlass; so that no rational objection seems to present itself against the successful and advantageous application of this plan to the navigation of river rapids, wherever the volume of water and channel are sufficiently large and commodious.

This kind of navigation may be extended to any length of rapid, and where the channels are already prepared, as on the St. Lawrence, for instance, at a less expense than would be required to construct a common road. Every boat, while ascending, would deposite the chain in nearly the same situation in which it was before it passed over the windlass; hence, any number of boats, admissible by the length of the chain, could be propelled at the same time in succession against the current. Nor would tow-boats be essential for this purpose; since the propelling apparatus is neither so burdensome nor cumbrous that it may not be conveniently affixed to boats freighted with merchandise, whenever occasion requires; and when passed, be detached, and stowed out of the way.

The wheels of a steam boat may be applied in the same way, while the power of steam may be made to act conjointly with that of the current, to effect the same object. In either of these cases, a chain or rope, anchored at one end and buoyed up at the other, would only be necessary. On arriving at the foot of a rapid, a few minutes' detention would be required, to *slip* the buoy, and secure it again after the chain had been arranged. When the rapids have been passed, a similar delay would follow, for the detachment of the boat from the chain, which would be the only inconveniences attending this mode of navigation.

Some of our rivers will not admit of this kind of navigation, on account of their obstructions: and there are others again, where its utility has been superseded by the perfection of other plans: but many still remain unimproved, where it may forthwith, or at some future time, be applied with great advantage to the public.

Among these are the St. Lawrence, Penobscott, Kennebeck, Delaware, Susquehana, Roanoke, Yadkin, Savannah, Tennessee, Cumberland and Ohio Rivers: and do doubt there are many others in the United States, which are equally well circumstanced for this kind of improvement.

Most of the rapids in our large rivers are occasioned by ridges of rocks, which often oppose discouraging impediments to improvements suited to this kind of navigation. But, since a boat may be passed with great facility and safety against any current in which it can be safely anchored: and as the resources of art are at command to form artificial channels, and to coerce a flow of water through them, the difficulties necessary to be overcome, are by no means so great as they at first appear.

It should be recollected that in general, even for the navigation of steam-boats, only two to three feet depth of water will be wanted in these channels; and that part, if not the whole of this can be obtained below the natural surface of the water

Flooded rocks may be blowed with gun-powder and removed with nearly as much ease as if situated on dry land, nor will the operation in general require so great an expense;* and wing and side dams to the moderate height required, may be constructed of the rocky fragments cleared from the channel, at a very inconsiderable expense.

These dams it is true would require timber ties and cappings; but as they would be constantly below the surface of the water, they would last a great number of years.

In cold climates, running waters remain free from ice much longer than when they are in a comparatively stagnant condition; and this difference is particularly observable between large rivers, and canals of the ordinary dimensions; hence a very importont advantage would result from the adaptation of the former, to the purposes of navigation. But as applicable to trading intercourse, even this great as it is, dwindles into insignificance when compared with the immense saving of expense that must result from the adoption of this kind of navigation, wherever circumstances will permit, instead of locks and canals. These are considerations which claim particular attention in the United States, more especially as our population is much scattered; our means limited; a cheap and easy intercourse very essential in many points of view, as our country is extraordinarily favoured by nature in the number, size, extent and ramification of waters which are capable of being rendered navigable.

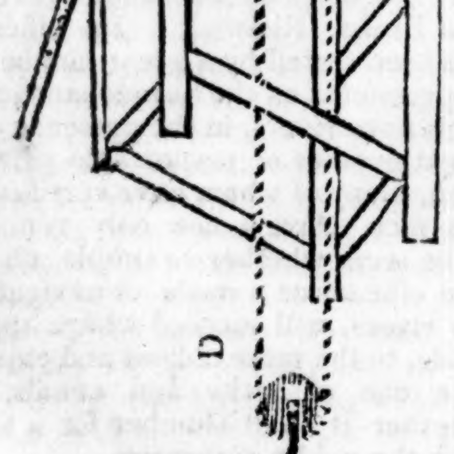
We have extended this article to a greater length perhaps, than our readers may think the subject merits; but from the extreme caution with which every new thing is adopted in this country, and the course which this project for navigating our rivers has taken, this prolixity seemed due to its development and correct appreciation. We shall conclude by merely remarking that this plan is highly approved of by some of the most eminent engineers in our country, among whom may be named, Genl. Swift, Col. Totten, Judge Wright and Profss. Renwick. Its efficacy has been tested by a great number of experiments on the Susquehanna and Delaware rivers, in the presence of a great number of respectable gentlemen, many of whom have certified to the fact. And it now only remains to be seen, whether so simple, cheap and efficacious a mode for navigating our rivers, will succeed where applicable, to the more tedious and expensive one of locks and canals, or whether it shall slumber for a time with the public enterprise.

* This will be illustrated in a future number, by a plan for boring rocks under water.

THE WHEEL AND AXLE.

Is generally denominated the second mechanical power, but if we analyze the principles by which it operates, it is clearly a lever of the first order, the centre of the axle (speaking popularly) being the fulcrum, its radius the short end, and the radius of the wheel the long end of the lever; and the advantages gained, are in the ratio of the length of the latter to that of the former; so that when it is proposed to increase them, either the diameter of the wheel must be augmented, or the axle diminished.

But it will readily be perceived that this arrangement when reduced to practice, cannot, from the required strength of the axle, and the space necessary for the wheel be very much extended. Therefore, whenever the effect of these disproportions is required to be increased, another wheel and pinion or a system* of pulleys are combined. But a machine constructed conformable to the annexed figure is far preferable, and it is extraordinary, that the advantages which it offers combined with so much cheapness and simplicity, should have so long escaped the discernment of practical men.



A Represents a capstan of two different diameters, as shown at B and C, set in frame work.

D A pulley furnished with a hook for the attachment of bodies required to be removed.

This windlass or capstan may be worked either in a horizontal or vertical position.

The rope, which passes round the pulley D, and sustains the weight or traction, is wound on the two diameters of the windlass, as represented at B and C, in different directions. When the windlass is turned so as to collect the rope upon its largest portion at B, it will be unwound from the smaller at C, and the quantity unwound at each complete revolution will be equal to the difference between the two different circumferences of the windlass, and the pulley will be drawn nearer, by one half the same space.

If the upper barrel B, were 17 inches diameter, and the lower C 16 inches, the pulley D being also 16 inches diameter it will be obvious that this simple capstan will be equivalent to an ordinary capstan of the same length of bar or lever and diameter of barrel C, combined with a 16 fold tackle of pulleys; and at the same time free from the great loss by friction and bending of ropes, which would absorb at least a third of the power of a 16-fold tackle. One peculiar advantage of this engine is, that the half difference of the radii of B and C may be diminished *ad libitum*, without weakening the cylinder, increasing the friction, or requir ng any rapid curvature of the rope. The windlass has likewise the peculiar property of holding the weight at any part of its rise or fall without needing a wheel and catch.

Its only practical disadvantage, is that a great quantity of rope must be used to produce a moderate change in the position of the weight; but the quantity of rope will be much less than what is requisite for an equivalent tackle of pulleys.

The celebrated *George Eckhardt* invented this ingenious machine, and introduced it to modern notice; notwithstanding, it was known to the Chinese long ago.

The figure in the foregoing article on the wheel and axle, was taken from a cut on leather. We do not profess to be an artist in this line, and therefore shall make no apology for the style and finish of the performance, nor do we attach much consequence to the suggestion of substituting this article for wood, in particular cases as this note is designed to do; but as we believe it novel, we have thought thus much necessary to preface the few remarks we have to offer on the subject.

The expense which attends the delineation of figures or representations of machinery on wood-cuts of any considerable dimensions, no matter how plain, is in the United States too great to authorise their insertion

into periodical works; because the patronage extended to them generally speaking, is too limited and precarious. With a view to diminish this expense, and promote the facility of diffusing this species of information, which in comparison to written descriptions possesses all the advantages of the Lancasterian over the older methods for imparting knowledge, a number of experiments were made for taking impressions from calf skin cemented to plates of tin, with the copper-plate press. The skin cemented to the plate by shellac dissolved in alcohol, the lines were traced with a sharp blunt pointed penknife gaged so as to prevent an incision through it, and the impressions, taken in precisely the same manner as those from music plates, with the exception of the application of heat, were clean and neat, but the skin, probably in consequence of lavation in the alkaline liquor, imparted a stain to the paper, and in some instances, in consequence of the small holes occasioned by the removal of the hair, left an appearance not unlike that of aquatinta engraving. These objections could no doubt be obviated by dressing the leather white, purposely for the object. Care should be taken, where the lines approach each other at a slight inclination not to join them, for in such cases, the epidermis, separates from the skin; the prints are imperfect. Figures of reference are made with sharp steel types or dies. The principal difficulty to be overcome in this skutographic printing, is the preservation of the plate; for after they have been once wet, the incisions open considerably when the leather dries

In conformity with the same views, these experiments were extended to the construction of a cut on leather of greater thickness and consistency, and the result of the only one completed is that given in the preceding article.

The leather was made to cohere in a manner similar to that just described, to a block of wood of the requisite thickness, and after the cut was made and type metal letters introduced, as points of reference, the whole was covered with two or three coats of shellac varnish.

Nearly a thousand impressions have been taken from it, without its having sustained the appearance of the slightest injury, and that too before its use on the present occasion.

They may be of service, particularly for large figures, and perhaps for, printing furnitue paper, but how far will be left for those to judge whose interests are more particularly concerned. [Ed.

SIR,—Seeing in your valuable Magazine a communication from S. E. asking information respecting the process of manufacturing sugar from Beets, I send you the following for publication.

ON THE CULTURE AND PRESERVATION OF THE BEET ROOT.

The seed is sowed in the latter part of March or beginning of April. In general the root is gathered in the beginning of October, and the operation is terminated towards the fifteenth. The time of gathering is not a matter of indifference, for the crystallizable sugar is contained in the root only for a certain time, this is the period for gathering it.

In order to keep the beet root in a proper state it should be stored in a dry place, of a temperature a few degrees above Zero.* It must not be stored when wet, and if the weather will permit, it ought to be left a few days in the field to dry. It should also pe carefully kept from the frost. To extract the sugar, it should first be well washed, then the beet is reduced to a pulp by means of graters. The best of these graters consist of cylinders, furnished on the surface with indented plates; these cylinders should be moved so rapidly by means of wheels, as to make 400 revolutions in a minute, and then they will reduce the root to a pulp with great expedition. In order that the pulp may be of good quality, it should have the

* Of Reaumur's thermometer.

appearence of a soft paste without any lumps; for the press however powerful, can extract but a small proportion of juice from the fragments that have not been reduced to a pulp. When it is crushed between millstones, like apples for cider, the juice that is obtained from the press does not amount to more than 30 or 40 per cent; when grated it often exceeds 65 or 75 per cent. As fast as the pulp is formed it is submitted to the press to extract the juice; the operation is perfect when by squeezing the dregs in the hand no juice comes from them. The pulp should be pressed as fast as it is formed, or otherwise it ferments and blackens, which renders the extraction of sugar more difficult. The juice is then put into a boiler, which, (supposing two operations to be effected in a day, and that 5000 weight of beet root is operated on each time,) should be, semispherical 5½ feet wide and 3 feet 8 inches deep, to contain these products. As soon as the boiler is half, or one third full, the fire is lighted, when it has acquired the heat of 65 degrees* the fire is smothered by covering it with wet coals. In the next place lime slaked with warm water is to be thrown in, at the rate of forty-eight grains to a *litre* † of juice. It must then be well stirred for some minutes, and the fire revived, in order to raise the heat to eighty degrees ‡ The fire is then taken out of the fire place. As the liquor cools, a coat of some consistence forms on the top, which at the end of three quarters of an hour, must be skimmed off.

A cock fixed about a foot from the bottom of the boiler is now turned, and the liquor runs off through a filter into a square boiler. When this operation is finished, a second cock at the bottom of the boiler is opened to drain it entirely. This liquor is also made to fall on a filter and into the square boiler. Fire is next to be applied, and at the instant the liquor begins to boil, sulphuric acid, diluted with twenty parts of water, is to be added in proportion to a tenth part of the lime employed. It should be well stirred, in order to dry. Should there be any excess of lime or acid in the liquor, it may be determined by *tumsol* or *curcuma*, test paper. It is best to suffer an excess of lime to remain, which will be indicated by the colour imparted to the paper. After this 4½ per cent of animal charcoal, pounded to an impalpable powder is to be added at short intervals. After the last addition of charcoal, it is evaporated till it has acquired the proper consistence. It is then made to run into a smaller and deeper vessel, where it remains until the next day. Previous to boiling the syrup, the juice made the evening before and which still retains some heat, is filtered through a coarse woollen cloth. It is then poured into a round boiler 2 feet in diameter and 18 inches deep, till it is ¼ full and is then heated to 80 degrees, and should be continued at this temperature to the end of the operation. If it chance to burn, it is perceived by puffs of white smoke which come from the bottom of the boiler and burst through the surface of the liquor, diffusing a pungent smell. To prevent this, the fire must be slackened, the liquor stirred and the operation more carefully attended to. When the operation is going on well, the syrup boils dry, and with noise, it also detaches itself from the skimmer without drawing into threads, produces very little scum and no traces of black appear at the bottom of the boiler. The time proper to terminate the boiling of the syrup, is determined by the threads breaking dry between the fingers; at this stage the boiling must be discontinued, and in a few minutes after the syrup should be poured into the cooler, care being taken to pour it high in order that it may mix with the air which promotes crystalization. Soon after it is collected in the cooler, at night, the crystalization of the sugar commences and is almost always complete by the next day, so that in 24 to 48 hours the forms may be placed on the pots for the molasses to run. To refine with alcohol, the operation must be commenced as soon as the molasses begins to run, for if any time be allowed for the sugar to dry, the molasses forms a hard coat on

* =178 Fahrenheit.

† A litre (French measure of capacity,) is equal to 61.028 English cubic inches.

‡ 212 Fahrenheit.

the surface of the sugar, which the alcohol detaches with great difficulty, accordingly the moment the molasses begins to run, the surface of the sugarloaf, contained in the form, is to be scraped and a litre of alcohol 36 degrees above proof poured by degrees over the surface, the little orifice of the form being stopped and the base of the form being carefully covered to prevent evaporation. In two hours the orifice at the bottom of the form is opened and the alcohol runs off in the pot charged with a great proportion of the colouring matter; the operation may be repeated with half the quantity of fresh alcohol, the sugar is equal in whiteness to powdered sugar. It is then melted and put in the boiler with bullocks blood. The operation is terminated by claying the sugar. The beet furnishes 3 or 4 per cent of raw sugar, and sometimes from 4 to 5.

H. C.

OIL FOR WATCHMAKERS.

Sir,—Seeing in your excellent Magazine, an inquiry for the best method of procuring the finest Oil for Watchmakes, I have great pleasure in informing you of the most simple and certain method of purifying olive oil, and which I have seen tried with great success by Dr. Nooth, F. R. S.

Put the oil into a white glass bottle, hang it up in a window exposed to the sun; in two or three months it will be as clear and white as water, all the impurities being thrown to the bottom. The bottle in which the experiment was tried was square, and it was remarkable, that the sediment did not settle regularly to the bottom, but seemed thrown into the four corners.

I propose trying this experiment next summer with whale oil for lamps, and will let you know the result.

I am, Sir,
Your obedient servant,

H. M Vavasour.

Melbourne Hall, Dec. 3.

P. S. Some of the purified oil was given to a watchmaker at Bath, who highly approved of it.

STRENGTH OF LEATHER—FORCE AND VELOCITY OF HAMMERS.

Sir,—Various engagements have prevented me, hitherto, from replying to your inquiry.

First, to A. B. C., respecting my experiments on Leather, I beg to observe that the pieces subjected to my experiments were short, varying from seven to fourteen inches in length; about two inches at each end were occupied by the vices made use of in the experiment; the extension in all the specimens appeared most towards the centre of the pieces, producing in that part a proportionate contraction in width and thickness. I think it very probable that the mode of attaching the vices to the leather prevented the contraction near the ends, which otherwise would have taken place.

Second—Some of the fractures took place through the whole substance nearly at the same time, whilst others commenced on one side, in consequence of the resultant of the force not perfectly coinciding with the centre of the straps, although care was taken to make this coincidence as near as could be, and probably nearer than in the common use of leather straps will be found to be the case. One of the specimens of cow-hide was a little cut by the vice, and began to separate partially.

I am aware that if the straining force be applied to one side of a broad strap, it will be torn with less force than if all the parts of the substance are allowed to act together, just as we tear a sheet of paper by beginning at one edge.

Third—I did not measure the degree of *elasticity* in the course of my experiments. I am aware that it would be of some importance to determine the elasticity, and had there been any considerable share of this quantity visible, I should have done so; but I soon perceived the proper elasticity to be very small, and that whatever extension was produced by the weights nearly remained after the weights were removed. I also observed that many of the specimens suffered a considerable extension before they became sensibly impaired in strength.

In reply to your Correspondent relative to my experiments on the Force and Velocity of Hammers, I beg to observe that I used them of various weights, from five to fifty-two ounces, and also a two-handed beetle of twelve and a quarter pounds weight. My object was to ascertain the *greatest* force or velocity obtainable without extraordinary exertion.

The following list exhibits the weight, including the handles of some of the hammers tried, and the velocities observed:—

Lbs.		Feet per sec.
0.30	iron	59.5
0.68	iron	57.0
0.406	iron, short handle	36.0
0 87	wood	50.0
2.83	wood	56.0
3.52	iron, short handle	46.0
12.25	wood, two-handed	38.0

I afterwards tried the effect of different lengths of handle to the same hammer, the head being of iron, and weighing one pound.

	Inches.		Seconds.
Length of handle	42	Velocity	53
	36		54
	30		55
	24		57
	18		61
	12		64

The above being the *greatest* velocities, and as the least velocities may be any thing above eight feet per second, the medium may probably be not far from what I have given in my former letter. I find Dr. Young quotes Professor Robison in a note, and mentions twenty-five feet as the velocity of a carpenter's hammer; but the page or article is not referred to; if any of your readers can point out the place, perhaps something more interesting may be found.

I am, Sir,
Your obedient servant,
B. BEVAN.

Leighton, Dec. 7, 1824.

SINGULAR EFFECT OF PRESSURE.

SIR.—I observed a few days back, in the brewhouse of John Nealds, Esq. at Guildford, that the slightest pressure of the thumb on the head of the barrels of ale or beer, whilst working off the yeast, caused it to rush out, more or less, according to the pressure. Now, though the head of a cask of that description is at least inch and a half oak, yet the effect is as great as if it were a drum-head. I beg to know if any of your intelligent readers can explain the reason of the above-mentioned *action*; there being a diversity of conjectures on the subject, and a desire to promote scientific observation, will, I hope, plead my excuse for troubling you.

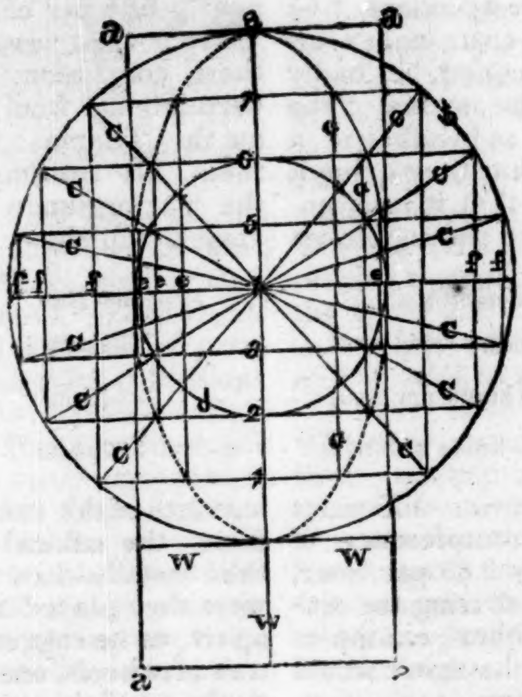
I am, Sir,
Your obedient servant,
J. W.

104, High Holborn,
Nov. 16, 1824.

PREPARATION OF BORAX IN PERSIA.

CRELL's *Annalen* for 1791, describes this as follows:—The water of an alkaline spring, which is hardly an inch in diameter, is collected in marble basins, and thence is conveyed into untinned copper kettles, where it is mixed with blood, urine, and scrapings of leather, and allowed to putrefy for five or six weeks. The deposite at the bottom of the kettle is then boiled with water, and on cooling, a rude but not crystallized species of borax, called by the Persians bora, is obtained.

CAUSE OF SOME STEAM-ENGINES REQUIRING MORE FUEL, OR USING MORE STEAM, THAN OTHERS, ALTHOUGH DOING THE SAME WORK.



SIR,—A few days ago, I happened to see two steam engines at work near each other; the one was the improved double reversing steam-engine, the other a continuous rotatory steam engine. this last was doing the most work, yet not consuming half the quantity of coal as the reversing engine. This led me to consider the cause, which may be understood by the following description of the properties of the reversing engine as it communicates its power to machinery by means of a crank.

[See the prefixed drawing.]

Description.

a a a a Represents the inside section of a steam engine cylinder, two feet in diameter, and five feet in length, adapted to give a four feet stroke; *bb*, a circle of four feet in diameter, agreeing with the length of the crank. The perpendicular diameter of this circle is divided into eight equal parts, as shown by 1, 2, 3, 4, 5, 6, 7, 8; through each of these parts lines are drawn at right angles to the perpendicular, until they intersect the circle *bb*. From each of these intersections lines are drawn to the centre of the circle *bb*, shown by *cc*. From the same centre is drawn the circle *dd*, equal to the diameter of the cylinder, *a a a a*. Through the places where the lines, *c c c c*, intersect the circle, *dd*, are drawn perpendicular lines, *e e e e*; perpendicular lines are also drawn in the crank circle, shown by *f f f f*. Hence it is evident, that the lines indicated by *e* have the same proportion to the oval formed within the cylinder, *a a a a*, as the lines *f f f f*, which are contained in the crank circle to the circle *bb*. The intersection of the lines marked *e* with the lines 1, 2, 3, 5, 6, and 7, gives the definition of the oval in the cylinder, which shows the distinction between the effectual and ineffectual portion of steam which must be used by the reversing engine to give a rotatory motion by means of a crank. The part of the oblong figure, *a a a a*, outside of the oval, shows the quantity of steam used in the reversing engine, *more than* that which would produce the same effect, in case the power was applied continuously and directly, and not reciprocally.—I have therefore taken the liberty of terming it ineffectual (use of) steam. The parts of the cylinder, *w w w*, show the ineffectual portion of steam used, which is contained above and below the piston, together with the side branches, nozzles, &c. which is unavoidable. Hence it follows (in round numbers,) that the best reversing (crank-working) steam-engines use about nine parts of ineffectual to eleven parts of effectual steam.

I am, Sir,

Your obedient servant,

A LOVER OF IMPROVEMENTS.

STEAM NAVIGATION.

Sir,—The Steam Vessels referred to by your Correspondent "G. Bayley." as having come under his observation, must indeed be badly constructed—if, as he states "the paddle-wheels have so insufficient a hold of the water, that they drive it aft to such a degree that it runs under the quarter at the rate of eleven to twelve knots per hour, while the real progress of the vessel is but six or seven knots, showing a loss of nearly fifty per cent"

From what vessels G. B. has drawn these conclusions I cannot judge—certainly not from any of those plying on the Thames: for, in reference to them, his statement is incorrect, as the performance of the following vessels will show:

	Velocity of paddle-wheel.	*Speed of Boat.*	*Difference.*
Eclipse	10.25 knots per hour	7.3 knots	2.95 knots
Albion	10.85 knots per hour	8.8 knots	2.77 knots
Venus	10.55 knots per hour	7.8 knots	2.75 knots

Here, then, the mean difference between extreme circumference of wheel and boat is only 2.82 per hour, or the portion lost in driving the water aft. Several other examples might be quoted, and the result would be found nearly the same.

I apprehend, with the present construction of paddle-wheels, this difference cannot be materially lessened without at the same time affecting the velocity of the boat.

The immersion of the floats ought to be calculated so as to absorb the power of the engine at its regular speed.

The position assumed by G B—"That the wheels of a steam vessel ought to be considered as a pinion working into a rack, and that the strength of the rack is but in proportion to the cubical contents between the floats"—does not apply: for, were they placed at five and six feet apart, as he suggests, in some diameters of wheels, one float would be entirely out of the water before the next one had entered it, causing great irregularities in the working of the engine, besides loss of power.

I am of opinion, that the best effect is likely to be produced when the wheels have a float for every foot they are in diameter, and the surface brought into action each moment of time should bear a certain proportion to the immersed section of the midship bend.

Horatio.

Tower, Dec. 7, 1824.

CURE OF DRY ROT.

Sir,—Your valuable publication being the medium by which various specifics and causes of the Dry Rot have been stated at different periods, and the subject being one of infinite importance to our naval greatness, I beg leave to offer a few remarks, which I hope will induce your abler Correspondents again to investigate the subject.

Mr. Burridge, in his treatise on Dry Rot, gives winter felling of timber as *its* only cure. Now, as the adoption of this method would destroy the bark, and thus enhance the price of oak timber itself, I wish to be informed the reason why American oak, *which is always felled in winter*, is peculiarly susceptible of the disease when it is used in the construction of British ships. I consider the Dry Rot in British oak timber to arise, more or less, from the nature of the soil in which it grows; as we find that Welsh oak by no means equals in duration Hampshire growths, although both are apparently good.

The Dry Rot, at the conclusion of the last war, had attained its height in the British navy; the disease was

then created and nourished by the pernicious practice of building ships from various descriptions of timber; American, Baltic, and British oak being mixed with pine, elm, and ash, the various juices of which, on being closed up, produce a chemical action, and cause what we denominate dry rot.

This is evident from each of the above sorts of timber, when used alone in ship building, producing a good and lasting vessel. Look at, for instance, the pine ships of Norway and Sweden, the oak ships of Holland, &c. As a remedy for this evil, I would recommend the discontinuance of the practice of using various sorts of timber in the same ship; and that when the vessel is on the stocks, all between the timbers should be filled with salt, which effectually prevents vermin, and by destroying any living principle in the timber, eradicates dry rot. The national and mercantile navy of the United States of America have long used salt with the greatest advantage, and I have seen several ships so treated open perfectly sound. The first apparent objection to salt is the creation of damp; but an inspection of the American packet ships at Liverpool, or elsewhere, will remove any prejudice on that head.

Several American captains have informed me, that the use of salt in their ships is productive of no inconvenience. I intend giving salt a fair trial, as a cheap remedy to prevent decay in ships, and recommend the subject to others.

I am, Sir,
Your obedient servant,
A Ship-Owner.

Dublin.

NEW TALLOW LAMP.

Sir,—In perusing your Magazine, I find the description of some very curious lamps. Now, it strikes me, that if lamps were constructed to burn tallow instead of oil, the light would be greater, and the smoke and smell imperceptible, compared with what is produced by oil. I have in my possession, and of my own inventing, one of this description, which I call a Tallow Lamp.

It is constructed of brass, somewhat in the shape of a common candlestick, and is more portable and safe than a candle. When trimmed according to my directions, it will be found equal to four candles, of six to the pound, and will burn with a steady light, without snuffing, &c. for three hours. The degree of light is regulated by turning a small cock or screw with the finger and thumb, when the light is instantly made la ger or smaller, and su table to any purpose.

I have used this lamp to solder with ever since I made it, and find that large and small articles may be soldered with pleasure; spirits may also be evaporated, eggs cooked, and silver, gold, or brass melted by it. One pound of tallow and three inches of wick will light up one of my lamps for six nights, burning three hours each night.

I am, Sir, &c.
M. Monnom, Watchmaker.

Broadway, Worcestershire.

[We shall be glad to receive a more particular description of the construction of this apparently useful lamp, and a statement, founded on the inventor's experience, of its economy compared with candles.—Ed.]

UNION OF COPPER WITH IRON, &c.

By Mr. P. N. Johnson, Mineralogist and Assayer

The combination of Copper with Iron, although stated by many writers on metallu gy to be capable of uniting in an *indirect* way, is yet by most operative men, as casters of copper, and others, positively denied to have any such capacity.

I have had my attention directed to this subject, by being summoned as an evidence in a cause Smith *vs.* Frost. Mr. Smith, who uses copper pans to boil the ingredients for making a green pigment for painting and dyeing, had been recommended to make use of cast pans, to save the expense of wrought ones; but these not answering his purpose, he employed me to inspect and give my opinion on them. In my experiments I proved

the presence of tin and iron; the latter was in a very minute quantity: but from the proportion of the former the contract was supposed to be vo d. The opposite party, however, being coppersmiths or casters, positively asserted the impossibility of the uni n of copper and iron; and finding, on inquiring of several persons in the same way of business, that a similar opinion generally prevailed, I resolved to make some experiments to prove how far it was possible to unite these metals.

I first mixed 100 parts of copper with two of iron, covering them with rosin, and filling the crucible with powdered charcoal. After being exposed to about 90° of Wedgewood's thermometer for a quarter of an hour, the mixture gave a clear lump of copper not quite so malle ble as when unadulterated, and with a redder grain.

I then endeavoured to ascertain how much iron the copper would take up, by covering 400 grains of pure copper with iron filings, and filling the crucible as before The produce was 880 grains, of a large red grain, bubbled in the inside as if occasioned by confined air, with a clean, uneven surface, and possessing nearly the melleability of zinc.

The next thing was to prove the existence of the iron by the usual process of analysis. The increased weight, indeed, clearly proved its presence: but I thought the analysis necessary, to prove that only the iron had entered into the composition.—As the iron I had used for the foregoing experiments was slightly oxidated, I fancied this might have facilitated the union. I therefore subjected 400 grains of copper covered with black oxide of iron (the crucible filled with charcoal) to a strong degree of heat for half an hour. The produce was, 526 grains of copper, remarkably red, which, on analysis, nearly answered to the increased weight as metallic iron.

I consider the iron to have been the cause of the copper having such a red appearance, from its partially oxidating it: it may perhaps, too, have had the effect of making it more brittle, by separating the particles of metallic copper. I farther ascertained that this oxidation greatly facilitated the combination. Having melted 400 grains of pure copper with a clean bit of thick iron wire, taking care to cover the crucible well; as in the former experiments, the produce was a lump of copper, in the heart of which a bead of steel (containing a proportion of copper) was found enclosed, with some loose bits of steel, on the surface of which a few grains of bad copper were to be perceived. The copper was very melleable, but not so much as when unadulterated, and containing only 4 1-2 per cent. of iron.

The formation of the steel may, of course, be accounted for by the crucible being filled with charcoal, to prevent the oxidation of the copper.

Although the union of these two metals is certainly not so perfect as that of other metals, yet I trust that those who credit these simple experiments will abandon the prejudice of there being any impossibility in their combination. For my own satisfaction, I have made several experiments in uniting copper with other metals; and perhaps you may consider them sufficiently interesting to give them also a place in your pages.

What more particularly struck my attention was, the effect of arsenic when melted with copper. It altered the colour, without increasing the weight of the copper, being no doubt volatilized.

United with the two hundredth parts of arsenic, the copper was rendered whiter, softer, and more ductile, but not increased in weight.—United with ten hundredth parts of arsenic, the copper, as in the former case, was not increased in weight, but became very white, and not quite so melleable.

It may be necessary, however, to observe, that I used the glass or oxide of arsenic, which might have facilitated its evolution; although, as the crucibles were filled with charcoal dust, I thought this would have prevented any such effect.

Copper united with two hundredth parts of tin was rendered less malleable, became of a flaky bright when

suddenly flattened by hammering, was smooth in the fracture, and had a colour inclining to yellow, and somewhat whitened.

Copper united with two hundredth parts of lead assumed a bright flaky appearance when hammered, and the malleability was much diminished.

Copper united with two hundredth parts of zinc was rendered softer and less ductile, but not so flaky as when united with either tin or lead; the fracture was of a dirty red colour.

ROLLING MILL.

Sir,—I addressed you on the 16th of April, in reply to some of your inquirers, with a communication that, in this neighbourhood, there is a Rolling Mill where they manufacture lead of a superior quality, for the prevention of damp in walls of rooms. Since then I have found, in perusing your valuable Magazine, other inquiries to the same purport, which has induced me to forward to you samples of the lead for the above purpose, that you may be enabled to show the said samples, to any of your numerous Correspondents or friends that will take the trouble to call upon you. It may not be unnecessary, therefore, to point out the advantages of this lead.

As soon as it is nailed on the wall, the place may be instantly repapered or painted: when any alteration is made in a room, such as stopping up any door or window, or the breaking out of others, it takes, according to the ordinary method, a considerable time before the lime is sufficiently dry to admit the room being finished, but, by applying the remedy here proposed, the damp is effectually prevented, and the room may be finished, either by painting or papering, without any loss of time.

I am apt to think, were it more generally known, it would be a valuable article to painters and paperhangers, and to those who wish to have a good room without being annoyed with damp.

The manufacturers are Messrs. Hutchinson and Co., Rolling Mill Company, Pately Bridge, Yorkshire.

I remain, Sir,

Your obedient servant,

J. W.

TO REFINE CAMPHOR.

Mix three or four parts of camphor with one part of quick lime, and then subject them to a moderate heat, when a beautiful white camphor may be obtained by sublimation.

LANA'S BALLOON.

Mr. Editor,—In looking over some old books a few days ago, I found the following little account of a very early attempt to construct balloons. If you think it worth inserting in your miscellany, it is at your service.

Yours, obediently,

Black Letter.

"Lana was an Italian Jesuit, living, we believe, in the north of Italy, and in 1670 published a book at Brescia, under the title *Prodromo dell Arte Mæstra*, in which he describes, or rather dreams of a boat, having a ball of copper, twenty feet in diameter, the substance of which was to be 1-68th of a line thick, fixed at each corner. His boat was to have a mast and sail, but how she was to be raised does not appear, for his scheme of exhausting the air of the balls would not answer the purpose. Gallien, who published, in 1755, *L'Art de Naviger dans les Airs*, seems to have dreamt more scientifically than Lana, for he proposed to construct a machine of linen, covered with wax and tar, the belly of which was to be filled with air lighter than the atmosphere. From such imperfect beginnings did the present science and art of aerostation arise."

ANSWER TO INQUIRY.

CONSTRUCTING REFLECTING TELESCOPES.

SIR,—Your insertion of my "Solution of the Geometrical Exercise," induces me to trouble you again.

One of the fundamental laws of optics may, in reference to curve surfaces, be put into this form:—*In the reflection of light, the incident and reflected rays form equal angls with a tangent to the curve at the point of incidence.*

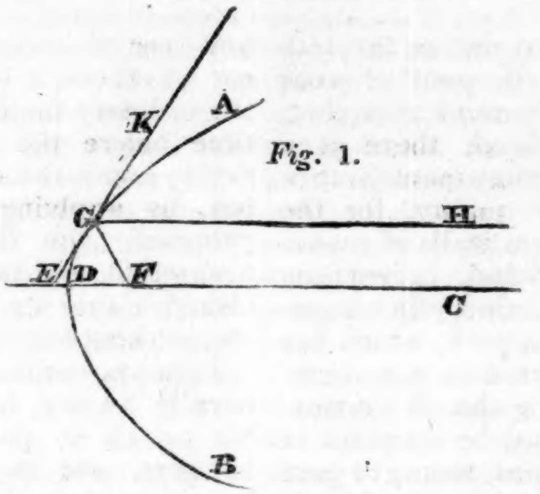


Fig. 1.

Let *ADB* [fig. 1.] be a central section of a speculum perfectly parabolic, of which *CD* is the axis, *D* the vertex, and *F* the focus.—Since. from the nature of the parabolia, every diameter, *GH*, and its focal chord, *GF*, make equal angles with the tangent, *KGE*, drawn through its vertex, *G*, every pencil of rays, *HG*, parallel to the axis, *CD*, [which, according to the law specified above, is always reflected in the direction *GF*, so that the angle *FGE* equal *HGK*,] meets *CD*, after reflection, in the same point, *F*, the focus of the paraboloid; consequently there is no abberation of rays, that is, no confusion of images, at the focus of a perfectly parabolic speculum. The image which is there formed of an object indefinitely distant is *perfect*, depending for distinctness* conjointly upon the magnitude of the speculum and its reflective power.

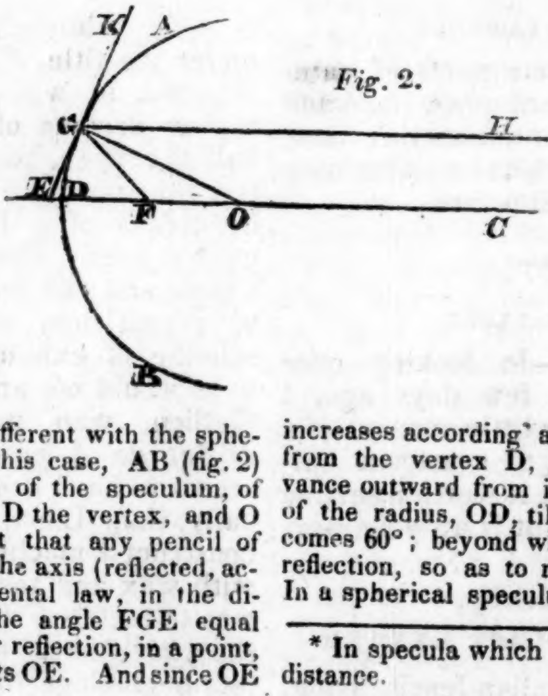


Fig. 2.

The case is very different with the spherical speculum. In this case, AB (fig. 2) being a central section of the speculum, of which CD is the axis, D the vertex, and O the centre, it is evident that any pencil of rays, HG, parallel to the axis (reflected, according to the fundamental law, in the direction GF, so that the angle FGE equal HGK) meets CD, after reflection, in a point, F, which always bisects OE. And since OE increases according as the point G recedes from the vertex D, the point F must advance outward from its limit, the bisection of the radius, OD, till the angle, DOG, becomes 60°; beyond which, of course, single reflection, so as to meet the axis, ceases. In a spherical speculum, therefore, all the

* In specula which have the same focal distance.

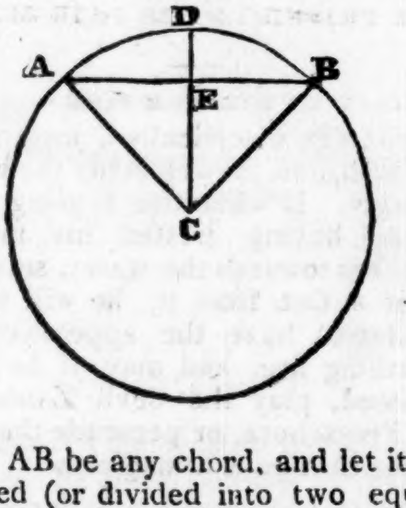
pencils of rays coming from an indefinitely distant object, which are reflected from the circumference of any given circle whose centre is D, meet at a point of the axis peculiar to themselves; that is, every cone of reflected rays has its vertex in a different point of the axis between the limit of the point F and D. This occasions the *aberration* of a spherical reflector. A succession of images is thus formed, less perfectly blended as the point F recedes from its limit nearest to O; consequently no perfect image whatever can be formed by parallel rays reflected from a spherical surface. The confused image, however, which is formed, approaches perfection in proportion as the angle, DOG, is diminished. Hence Mr. Barton will readily perceive, that of specula formed of the same materials, and containing the same quantity of reflecting surface, that is the best which is a portion of the largest sphere.

I am, Sir,
Your most obedient servant,
NATHAN SHORT.

MECHANICAL GEOMETRY.—NO. III.
(Continued.)

THEOREM IV.

If from the centre of any circle a radius be drawn to the circumference, bisecting any chord, it will be perpendicular to the chord.



Let AB be any chord, and let it be bisected (or divided into two equal parts) in the point E, then, if from the centre C we draw a line or radius to the circumference at D, and passing through the point E, the radius, CD, will be perpendicular to the chord AB.

For (by Theorem I. Part I.) the line CE standing on the line AB makes the angles AEC and BEC, when added together, equal to two right angles; now draw the line CA and CB. which, as they are radii to the same circle, are equal to each other (by definition III Part II.), then we shall have two triangles, AEC and BEC, whose sides are all equal each to its corresponding one, that is, AE equal to BE, CA equal to CB and the side EC belongs to both triangles; and hence if these triangles are laid on each other, they will correspond in every respect, or will be identical triangles, and the angles will also correspond; hence we shall find the angle AEC of the triangle AEC will correspond to the angle BEC of the triangle BEC, that is, they will be equal. But we have shown that the angle AEC added to the angle BEC is equal to 180 degrees, or two right angles; hence either of them will be equal to the half of 180 degrees (or 90 degrees), which is the angle of a right angle. Thus DEC is perpendicular to AEB.

COROLLARY 1.—Hence the converse of this Theorem, viz. that if any radius is perpendicular to a chord, it divides that chord into two equal parts, or it bisects it.

COROLLARY 2.—Hence also we see that when any radius bisects a chord, it also bisects the arc of that chord; that is, if CD bisects AB, it will divide the arc ADB into two equal parts; that is, AD and DB will be equal to each other.

COROLLARY 3.—We also see, by this Theorem, that when two triangles have their sides severally equal to each other, their angles will be severally equal to each other.

COROLLARY 4.—Hence we have also the method of bisecting any angle: for if, at the angular point C, we draw an arc, ADB, and bisect its chord, in E. if we draw from C, through E, a straight line, it will bisect the arc ADB and consequently the angle ACB, which is measured by the arc ADB.

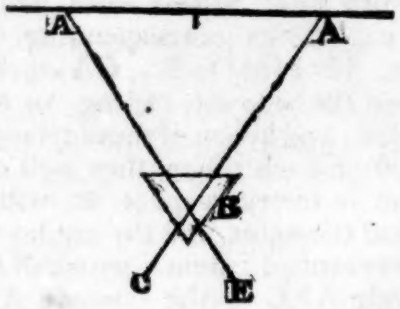
G. A. S.

(To be continued.)

EXPANSION OF PENDULUM RODS.

Sir,—You will oblige me by inserting the following design in your useful

Magazine; it is intended to obviate the difficulty arising from the expansion of pendulum rods.



In the plan here represented, AA are the two points of suspension for the pendulum rods, and B the pendulum weight; CC, the ends of the pendulum rods. In B there are two holes in the directions AC, AC, sufficiently large to admit the pendulum rods to move freely. Now it appears to me that the weight, B, would neither rise or fall by any increase in the length of the rods AC, AC; consequently the weight of the pendulum would be uniform.

The space occupied by such a pendulum might be too great for a common Dutch clock, but I have seen some eight-day clocks where, I conceive, such a pendulum would be used to advantage. Should any of your readers try the plan, they would oblige me by inserting their results in your Magazine.

I am, Sir,
Your obedient servant,
SIMON.

MAN-MILLINERS.

Sir,—Having lately been travelling through France, I observed that, in the management of their shops, the French have a great many excelleut customs which we might copy with advantage The one, in particular, to which I wish to call the attention of my brother mechanics, is the greater employment which is given to women. In England we exclude females from almost every employment, and from some in particular, to which they are much better adapted than men. All our shops at which haberdashery, lace, feathers, and such like light and fancy articles, are sold, are served by men. I have often felt quite ashamed to see a great tall, stout fellow standing behind the counter, and serving out ribbons and tape. In France this is considered as the business of the women, and I think with great propriety; for the very exp ession, *Man-milliner*, implies a sort of nondescript animal, and is a reproach to a *man.* In the same manner, in France, women are often employed in all kinds of shops in the capacity of clerks. Why should not a woman who is a good accountant make a good clerk? The wife of a friend of mine, who has a large shop at Paris, keeps all the accounts; and a better, and, I may add, a prettier clerk I never saw. When we consider that the number of women brought into the world equals the number of men, is it not right that all employments which are suitable to them should be kept free of intruders? I put it to the good sense, not to say the gallantry, of my brother mechanics, whether it is proper to exclude the weaker sex from such employments; and whether it would not be for the benefit of all parties, that there should be more women-milliners and fewer man-milliners?

I am, Sir, &c.
A FRIEND TO THE FAIR SEX.

TO BREATHE FIRE.

ISOLATE electrically a large shallow dish, and then electrify the water strongly. If while this is going on, a person having wetted his mouth, breathes towards the water, standing about a foot from it, he will to the spectators have the appearance of breathing fire, and may, if he be so disposed, play the devil Zamiel, in the Freyschutz, or persuade the credulous that he is a magician.

MAGNESIA AND OIL.

CALCINED magnesia has the property, if rancid oil be heated with a qu ntity of it, completely to destroy the rancidity of the oil.

CORRESPONDENCE.

S. is received and will meet with attention.